THE FLORA OF CHICKEN KEY, DADE COUNTY, FLORIDA: BEFORE AND AFTER HURRICANE ANDREW

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ABSTRACT

Complete lists of the species of vascular plants in the flora of Chicken Key in Dade County Florida were generated during surveys of the key on five occasions over a period of five years, including surveys conducted just before and just after Hurricane Andrew (which impacted the key on 24 Aug 1992). Although the short term effect on the species richness of the key was dramatic (a drop from 72 to 63 species), the post hurricane species richness is still well within the known range for the island, indicating that the long term effects on the species composition may not be significant.

RESUMEN

Se realizo la lista completa de plantas vasculares del "Chicken Key" (Cayo Pollo) en el condado de Dade de Florida. Fue elaborada en cinco visitas, durante un período de cinco años, e incluyen reconocimientos ilevados a cabo inmediatamente antes e inmediatamente depué del huracán Andrew (que afectó el cayo el 24 de agosto de 1992). A pesar de que el impacto inmediato en el número de especies fue dramático (una reducción de 72 a 63 especies), la diversidad después del huracán está aun dentro del rango normal para la isla, indicando que los efectos a largo plazo sobre la composición de la flora, probablemente no sea significativo.

INTRODUCTION

Chicken key is a natural sand island located at 25°37'15 "N. lat. and 80°17'9 W. long. in Biscayne Bay approximately 3/4 km south of Paradise Point, just south of Miami, Florida. Although only 2.8 ha in size, the island has more relief than a typical sand key due to a large oölite mound on its northern half made by the deposition of spoil from the dredging of a nearby canal in the 1940s. This operation changed the substrate from sand to bare oölite and the relief from one meter to just over two meters above sea level (Babb et al. 1991), thereby allowing colonization by a number of non-native and native plant species found more often in nearby pine rocklands.

The key is part of the Charles Deering Estate, a state-owned property administered by the Metro-Dade County Park and Recreation Department. There are no permanent structures on the island and although it has been popular as a campsite since settlement of the area, it has never sustained a permanent

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domicile. The Deering Estate has no plans to develop the island beyond the possible construction of a small docking facility and has posted it as a no trespassing area since 1987 (Babb et al. 1991).

The mangroves on the west side of the island are a major roosting area and rookery for several species of birds. Those observed roosting there included several herons (*Ardea herodias, Florida caerulea, Hydranassa tricolor* and *Butorides striatus*), egrets (*Casmerodius albus Egretta thula*), pelicans (*Pelecanus occidentalis*), and cormorants (*Phalacrocorax auritus*). The key is bordered on the east by a submerged sand bar and on the west by soft bottom shallows. *Thalassia testudinum* Koenig., *Halodule wrightii* Aschers and *Cymodocea filiformis* (Kuetz.) Correll are the common marine angiosperms found in the shallows.

This project began as a simple floristic treatment in 1987. From this treatment a preliminary manual was produced (Guala 1991). However, it is clear from the data presented here that the composition of flora of Chicken Key is dynamic and only long term studies such as the one presented here can truly describe the nature of the flora.

METHODS

In 1987 several trips were made to the key during the last week of July and a complete plant species list was generated. The key was then revisited on 26 Apr 1988, 24 Mar 1989 and 22 Jul 1992 and resurveyed, first for all species previously found in the flora, and then for additions. On 14 Sep 1992, two weeks after Hurricane Andrew, a preliminary post-hurricane trip was made to the key and on 24 Oct 1992 a complete resurvey was done.

All of the species found in 1987 and all subsequent additions to the flora are vouchered at the herbarium of the Fairchild Tropical Garden (FTG) and a duplicate set of the 1987 collections is deposited at Michigan State University (MSC).

Species nomenclature follows Wunderlin (1982) and updates (Wunderlin et al. 1985, 1988) except where noted (see footnotes 1-10). Family circumscriptions and nomenclature used here are primarily those of Lellinger (1985) for the ferns and Thorne (1992) for the flowering plants. However, recent work by Judd et al. (submitted) has shown that some modifications are necessary in order to achieve strictly monophyletic family circumscriptions. They have shown that Moraceae are paraphyletic without the inclusion of Urticaceae s.s. and, therefore, the two must be combined (as in Thorne 1983). The same holds true for the Apiaceae/Araliaceae pair, the Araliaceae s.s. being paraphyletic and Umbelliferae (Apiaceae) polyphyletic. Celtidaceae are recognized here because it is now clear, through the work of Grudzinskaia (1967) that this group shares no synapomorphies with the Ulmaceae s.s., although both are individually monophyletic. The Celtidaceae, according to Judd et al. (submitted) may be more closely related to Urticacreae s.l. than to the Ulmaceae s.s.

RESULTS

The actual numbers of species encountered on the 87, 88, 89, Jul 92 (hereafter designated 92I) and Oct 1992 (hereafter designated 92II) surveys were 60, 62, 65, 73, and 62 respectively. One species, *Sapindus saponaria*, was lost and three; *Melothria pendula, Phytolacca rigida,* and *Stenotapharum secundatum* were gained between the 1987 and 1988 surveys. Between the 1988 and 1989 surveys, four species, *Ficus altissima, Lysiloma latisiliqua, Spermacoce verticillata,* and *Trema micrantha*, were gained and only *Spartina spartinae* was lost. During the three years preceding the first 1992 survey only three species, *Blechum brownei, Catharanthus roseus,* and *Phytolacca rigida*, were lost but 12, *Baccharis halimifolia, Boerhavia diffusa, Dalbergia ecastophyllum, Desmodium incanum, Ficus microcarpa, Ipomoea pes-caprae, Passiflora suberosa, Phyllanthus tenellus, Psilotum nudum, Setaria geniculata, Sida acuta*, and *Vitis rotundifolia* were gained. Eleven species, *Baccharis halimifolia, Borrichia fructescens, Canavalia rosea, Chamaesyce buxifolia, Dalbergia ecastophyllum, Ficus microcarpa, Ipomoea pes-caprae, Pteris bahamense, Stenotapharum secundatum, Suriana maritima,* and *Urechites lutea* were found in the pre-hurricane (92I) survey but not the post-hurricane (92II) survey. The percentage of non-native species in both of the 1992 surveys is about 23%.

Appendix I contains a list of all species encountered over the course of the study. Each species is followed by the collection number of the author in brackets and the years in which it was encountered. The two trips in 1992, 92I and 92II, are the two full surveys completed before and after the hurricane. Also included at the end is a designation of native or non-native. Native is defined as putatively occurring in South Florida before European colonization.

DISCUSSION

The flora of Chicken Key, like that of most islands, is dynamic (MacArthur & Wilson 1967). The flora has been subjected to numerous catastrophes, both human induced and natural, which must have significantly altered the floristic composition over the years. In 1987 (before the first survey) a fire burned for three days on the island and destroyed much of the vegetation on the oölite mound which is itself the product of major disturbance. Although it is impossible to know the entire effect of previous disturbances, Hurricane Andrew, which directly passed over the key on August 24, 1992 (4 weeks after the first 1992 survey) provided a rare opportunity to observe the impact of a catastrophic natural disturbance on the floristic composition of the key.

During the hurricane the key experienced the harshest part of the storm extrapolating from the maps in Rapaport (1992). It was on the subjected to sustained winds of nearly 250 kph with gusts of 280 kph and a storm tide of over 5 m (estimated from Rapaport 1992). Every tree on the key was defoliated and showed at least some structural damage. More than 60% of the larger trees, including mangroves, were at least partially uprooted or snapped below the crown.

It is surprising that only 11 of the species recorded in July were not found again after the storm. All of the species that survived the storm, except *Cordia sebestena* with a single remaining individual, were represented by at least three apparently healthy individuals. Many of the species, including *C. sebestena* were in mass flower on October 24th.

Although exact numbers of individuals of each species were not recorded in any of the surveys, notes on the approximate number of individuals were kept for most of the less common native species and newly introduced non-natives. As one might expect, most of the species putatively extirpated by the storm were only represented on the key by a few individuals before the storm.

Furthermore, it would not be surprising if several of the putatively extirpated species returned from the seed bank, dormant subterranean organs or redispersal to the island. There was an influx of organic matter and devegetation of several areas which would probably aid the majority of lost species in their re-establishment.

Before the hurricane the island gained an average of about four species and lost one every year. This net gain may show that the species richness of the island was still recovering from some past degradation (most likely the fire) and that three species per year is a reasonable recovery rate to use for extrapolation. We can then propose that the island should regain its maximum known diversity in about four years. The unique substrate changes made by the creation of the oölite mound, the island's small and everchanging size, and the unknown difference between actual and effective distance from land make it nearly impossible to accurately calculate what the maximum possible diversity would be.

In conclusion, the massive destruction and reduction in standing biomass imposed by Hurricane Andrew was certainly significant. However, because the species richness of the island is still within the known long term range with virtually no change in the percentage of exotics it appears that the long term effects on the composition of the flora will be minimal.

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APPENDIX I. List of the vascular plant species on Chicken Key.

Name	Voucher No.	87	88	89	92I	92II	Native
ACANTHACEAE							
Blechum brownei Juss.	733	+	+	+		+	
AIZOACEAE							
Sesuvium portulacastrum L.	710	+	+	+	+	+	+
AMARANTHACEAE							
Blutaparon vermiculare (L.) Mears	709	+	+	+	+	+	+
AMARYLLIDACEAE							
Hymenocallis latifolia (Mill.) Roem.	678	+	+	+	+	+	+
ANACARDIACEAE							
Metopium toxiferum (L.) Krug & Urban	719	+	+	+	+	+	+
Schinus terebinthifolius Raddi	720	+	+	+	+	+	
APIACEAE							
Schefflera actinophylla (Endl.) Harms	679	+	+	+	+	+	
APOCYNACEAE							
Catharanthus roseus (L.) G. Don	713	+	+	+			
Echites umbellata Jacq.	687	+	+	+	+	+	+
Urechites lutea (L.) Britt.	724	+	+	+	+		+
ASTERACEAE							
Baccharis halimifolia L.	1487			+		+	
Bidens alba (L.) DC							
var. *radiata* (Sch.-Bip.) Ball. ex Melch.	691	+	+	+	+	+	+
Borrichia arborescens (L.) DC[1]	702	+	+	+	+	+	+
Borrichia fructescens (L.) DC	705	+	+	+	+		+
Conyza canadensis (L.) Cronquist							
var. *pusilla* (Nutt.) Cronquist	706, 711	+	+	+	+	+	+
Eupatorium serotinum Michx.	707	+	+	+	+	+	+
Pluchea carolinensis (Jacq.) G. Don[2]	728	+	+	+	+	+	+
AVICENNIACEAE							
Avicennia germinans (L.) L.	676	+	+	+	+	+	+
BORAGINACEAE							
Cordia sebestena L.[3]	722	+	+	+	+	+	+
Heliotropium angiospermum Murray	690	+	+	+	+	+	+
Heliotropium curassavicum L.	712	+	+	+	+	+	+
BURSERACEAE							
Bursera simaruba (L.) Sarg.	737	+	+	+	+	+	+
CASUARINACEAE							
Casuarina equisetifolia L.	681	+	+	+	+	+	
CELTIDACEAE							
Trema micrantha (L.) Blume	1156, 1478			+	+	+	+
COMBRETACEAE							
Conocarpus erectus L. var. *erectus*	1480	+	+	+	+	+	+
Laguncularia racemosa Gaertn.	685	+	+	+	+	+	+

[1]This species not included in Wunderlin (1982, 1985, 1988). See Long & Lakela (1971) for reference.
[2]*Pluchea symphytifolia* (P. Mill.) Gillis is not valid, see Howard (1988) for a discussion.
[3]D.B. Ward (pers. comm.) has expressed doubt about the native status of this species and is currently studying the question.

APPENDIX I. List of the vascular plant species on Chicken Key (continued).

Name	Voucher No.	87	88	89	92I	92II	Native
CONVOLVULACEAE							
Ipomoea indica (Burm. f.) Merr.	699, 700	+	+	+	+	+	+
Ipomoea violacea L.	735, 738	+	+	+	+	+	+
Ipomoea pes-caprae (L.) R.Br. subsp. *brasilensis* (L.) Van Oöstr.	1488			+		+	
CUCURBITACEAE							
Melothria pendula L.	745		+	+	+	+	+
DENNSTAEDTIACEAE							
Pteridium caudatum (L.) Maxon	715	+	+	+	+	+	+
EUPHORBIACEAE							
Chamaesyce blodgettii (Engelm. ex Hitchc.) Small	726	+	+	+	+	+	+
Chamaesyce buxifolia (Lam.) Small[4]	725	+	+	+		+	+
Chamaesyce hypericifolia (L.) Millsp.	697	+	+	+	+	+	+
Phyllanthus tenellus Roxb.	1485		+	+			
Poinsettia cyathophora (Murray) Kl. & Gke	736	+	+	+	+	+	+
FABACEAE							
Acacia auriculiformis A. Cunn. & Benth.[5]	708	+	+	+	+	+	
Caesalpinia bonduc (L.) Roxb.	732	+	+	+	+	+	+
Canavalia rosea (Sw.) DC	727	+	+	+	+	+	
Dalbergia ecastophyllum (L.) Taub.	1476				+		+
Desmodium incanum DC	1490				+	+	
Lysiloma latisiliqua (L.) Benth.[6]	1477			+	+	+	
LAMIACEAE							
Callicarpa americana L.	739	+	+	+	+	+	+
MALVACEAE							
Hibiscus tiliaceus L.	680	+	+	+	+	+	
Sida acuta Burm. f.	1486				+	+	+
Thespesia populnea (L.) Solander ex Correa	683	+	+	+	+	+	
NYCTAGINACEAE							
Boerhavia diffusa L.	1484				+	+	+
PASSIFLORACEAE							
Passiflora suberosa L.	1475				+	+	+
PHYTOLACCACEAE							
Phytolacca rigida Small	743		+	+			+
POACEAE							
Andropogon glomeratus (Walt.) BSP	723	+	+	+	+	+	+
Cenchrus echinatus L.	692	+	+	+	+	+	+
Chloris petrea Swartz[7]	717	+	+	+	+	+	+

[4]I accept the more conservative argument of Webster & Burch (1967) rather than recognizing the later combination *Chamaesyce mesembrianthemifolia* (Jacq.) Dugand.

[5]This species is not included in Wunderlin (1982, 1985, 1988). See Correll & Correll (1982) for reference.

[6]Ibid.

[7]I find no synapomorphy for *Chloris* if sect. *Eustachys* is removed from it.

APPENDIX I. List of the vascular plant species on Chicken Key (continued).

Name	Voucher No.	87	88	89	92I	92II	Native
Dactyloctenium aegyptium (L.) Beauv.	684	+	+	+	+	+	
Neyraudia reynaudiana (Kunth) Keng ex Hitchc.[8]	677, 1158, 1159	+	+	+	+	+	
Paspalum setaceum Michx.	96	+	+	+	+	+	
Schizachyrium sanguineum (Retz.) Alston	694	+	+	+	+	+	+
Setaria geniculata (Lam.) Beauv.	1479				+	+	+
Spartina spartinae (Trin.) Merr. ex Hitchc.	729	+	+				+
Sporobolus indicus (L.) R. Br.	693	+	+	+	+	+	+
Stenotapharum secundatum (Walt.) Kuntze	744		+	+	+		
POLYGONACEAE							
Coccoloba uvifera (L.) L.	682	+	+	+	+	+	+
PSILOTACEAE							
Psilotum nudum (L.) Sw.	489				+	+	+
PTERIDACEAE							
Pteris bahamense (Agar.) Fée	714	+	+	+	+		+
RHAMNACEAE							
Colubrina asiatica (L.) Brongn.	716	+	+	+	+	+	
RHIZOPHORACEAE							
Rhizophora mangle L.	730	+	+	+	+	+	+
RUBIACEAE							
Morinda royoc L.	688	+	+	+	+	+	+
Spermacoce verticillata L.	1157			+	+	+	
SAPINDACEAE							
Dodonaea viscosa (L.) Jacq.	698	+	+	+	+	+	+
Sapindus saponaria L.	734	+					+
SURIANACEAE							
Suriana maritima L.	721	+	+	+	+		+
URTICACEAE							
Ficus altissima Blume[9]	1160, 1482			+	+	+	
Ficus aurea Nutt.	686	+	+	+	+	+	+
Ficus microcarpa L.f.[10]	1481				+		
VERBENACEAE							
Lantana camara L.	704	+	+	+	+	+	
Phyla nodiflora (L.) Greene	731	+	+	+	+	+	+
Stachytarpheta jamaicensis (L.) Vahl	689	+	+	+	+	+	+
VITACEAE							
Parthenocissus quinquefolia (L.) Planchon	695	+	+	+	+	+	+
Vitis rotundifolia Michx.	1483	+	+	+	+	+	+

[8]This species is not included in Wunderlin (1982, 1985, 1988). See Guala (in review) for reference.
[9]This species is not included in Wunderlin (1982, 1985, 1988). See Howard (1988) for reference.
[10]Ibid.

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